

# Project Report

## Magical Blue Hole



Magical Blue Hole

Magical Blue Hole (MBH) is a sink hole located near Marsh Harbour, Bahamas ( $26^{\circ}22'31''\text{N}$   $77^{\circ}6'14''\text{W}$ ) that is more than 200 feet deep and hosts a plethora of microbial biofilms. MBH is stratified with oxic, freshwater on the surface and anoxic marine waters at depth. On the sides of the immersed cave walls, thick biofilms with interesting structural characteristics have been observed.

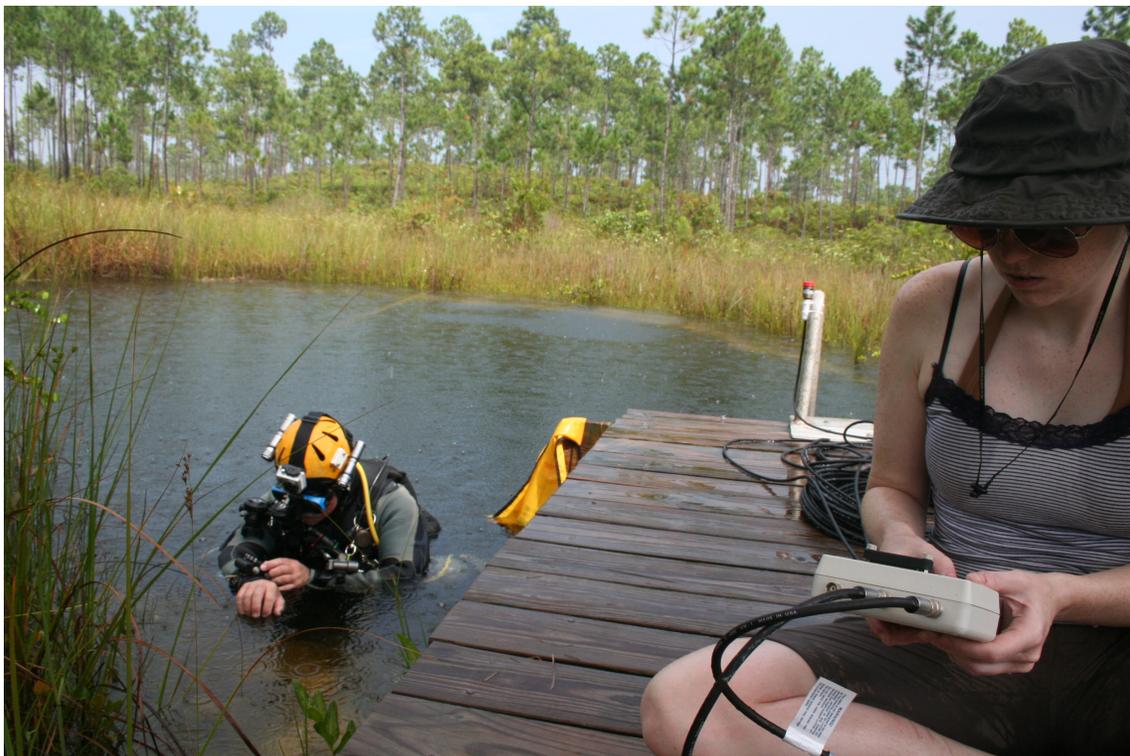
The main objective of this trip was to sample the microbiology and water chemistry of MBH in order to elucidate the microbial community composition and metabolic activity. Since this sink hole may have similar chemistry as early Earth oceans, it is a potential analog for Archean microbiology and geochemistry. Working with Brian Kakuk, an expert cave diver, we collected water and biofilm samples from 5 depths in MBH: 205', 153', 104', 85', and 30'. In addition to measuring water chemistry on site, we also deployed a multi-parameter data logger to determine pH, dissolved oxygen,

*Energy-Limited Microbial Communities as an Analog for Archean Life*

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Brian Kakuk and Becky McCauley preserving water and biofilm samples from Magical Blue Hole.



Brian Kakuk preparing to dive and Becky McCauley preparing a data logger at Magical Blue Hole.

chlorophyll concentration, oxidation-reduction potential, conductivity, and photosynthetically active radiation at various depths. We also completed a 13-carbon incubation experiment and used photographic films to trap sulfide production and use in the biofilm.

Samples collected from MBH will be analyzed using a wide array of instruments in the laboratory for DNA and geochemistry. Additionally, samples collected were used to inoculate media in the laboratory.

## **Sawmill Sink**



Sawmill Sink

Sawmill Sink (SS) is a sink hole also located near Marsh Harbour, Bahamas (26°13'3"N 77°12'37"W). SS is named for a sawmill that used to be located near by. Dust from the sawmill was dumped in to SS until the sawmill was closed years ago. SS is both similar and dissimilar to MBH. While both SS and MBH are stratified, SS has a highly sulfidic layer at depth that is not present in MBH.

While the main focus of this research trip was MBH, there was enough time to also sample at SS. Water samples were collected by Brian Kakuk in addition to the deployment of the multi-parameter data loggers. Water was filtered from depth using a pump. These filter samples will be used to identify the microbial populations living in the water column. The unusual sulfidic layer in SS is of much interest when discussing early Earth oceans, which may have been sulfidic during their history. Understanding the water chemistry and its relationship to the microbiology is important in elucidating the processes that would have governed these ancient oceans.

## **Blogging**

In addition to this report, there is an accompanying blog about my research experience at <http://magicalmicrobes.blogspot.com/>.